DRAFT

Grade 3

Science

Item Specifications

Updated December 2019

Missouri
DEPARTMENT OF ELEMENTARY & SECONDARY
EDUCATION

Grades 3-5 SCIENCE

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Grades 3-5 SCIENCE

Introduction

In 2014 Missouri legislators passed House Bill 1490, mandating the development of the Missouri Learning Expectations. In April of 2016, these Missouri Learning Expectations were adopted by the State Board of Education. Groups of Missouri educators from across the state collaborated to create the documents necessary to support the implementation of these expectations.

One of the documents developed is the item specification document, which includes all Missouri grade level/course expectations arranged by domains/strands. It defines what could be measured on a variety of assessments. The document serves as the foundation of the assessment development process.

Although teachers may use this document to provide clarity to the expectations, these specifications are intended for summative, benchmark, and large-scale assessment purposes.

Components of the item specifications include:

Expectation Unwrapped breaks down a list of clearly delineated content and skills the students are expected to know and be able to do upon mastery of the expectation.

Depth of Knowledge (DOK) Ceiling indicates the highest level of cognitive complexity that would typically be assessed on a large scale assessment. The DOK ceiling is not intended to limit the complexity one might reach in classroom instruction.

Item Format indicates the types of test questions used in large scale assessment. For each expectation, the item format specifies the type best suited for that particular expectation.

Content Limits/Assessment Boundaries are parameters that item writers should consider when developing a large scale assessment. For example, some expectations should not be assessed on a large scale assessment but are better suited for local assessment.

Sample stems are examples that address the specific elements of each expectation and address varying DOK levels. The sample stems provided in this document are in no way intended to limit the depth and breadth of possible item stems. The expectation should be assessed in a variety of ways.

Possible Evidence indicates observable methods in which a student can show understanding of the expectations.

Stimulus Materials defines types of stimulus materials that can be used in the item stems.

Grades 3-5 SCIENCE

Physical Sciences		3.PS1.A.1
Core Idea	**Matter and Its Interactions**	
Component	**Structure and Properties of Matter**	
MLS	Predict and investigate that water can change from a liquid to a solid (freeze), and back again (melt), or from a liquid to a gas (evaporation), and back again (condensation) as the result of temperature changes.	

Expectation Unwrapped	DOK Ceiling
SCIENCE AND ENGINEERING PRACTICES **Planning and Carrying Out Investigations** ● Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. **Analyzing and Interpreting Data** ● Represent data in tables and various graphical displays (e.g., bar graphs, pictographs) to reveal patterns that indicate relationships. **DISCIPLINARY CORE IDEAS** **Structure and Properties of Matter** ● Predict and investigate that water can change from a liquid to a solid (freeze), and back again (melt), or from a liquid to a gas (evaporation), and back again (condensation) as the result of temperature changes. **CROSSCUTTING CONCEPTS** **Cause and Effect** ● Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts. **ENGINEERING DESIGN CONNECTIONS** 3.ETS1.C.1	3 **Item Format** Selected Response Constructed Response Technology Enhanced

Grades 3-5 SCIENCE

Content Limits/Assessment Boundaries

- Tasks should not include placement or movement of molecules or how temperature affects molecule placement or movement.

Possible Evidence

- Students predict and investigate the water cycle, which includes the following idea: water has different properties depending on temperature.
- Students collaboratively develop an investigation plan and describe the evidence that will be collected, including the properties (e.g., whether it is a solid, liquid, or gas) of water that would allow for classification, and the temperature at which those specific properties are observed.
- Plan how water will be observed at different temperatures and how those temperatures will be determined (e.g. measuring the temperature of a stovetop burner or lamp used to melt ice) and measured (i.e., qualitatively or quantitatively).
- Students collect and chart data according to the results of the investigation.
- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question about the states of matter as it pertains to the water cycle using the following: frozen, melted, evaporation, precipitation, and condensation.

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

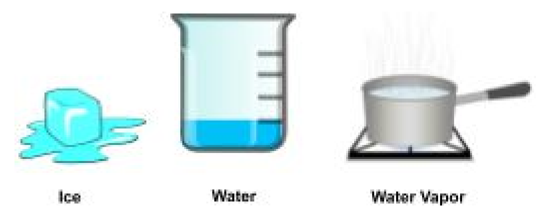
Sample Stems

Water Investigation

Water is a special substance for many reasons and reacts in specific ways when heated and/or cooled.

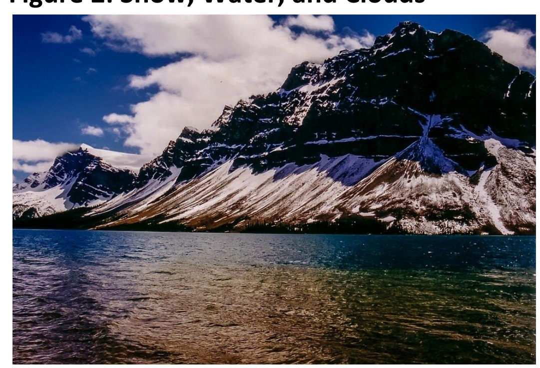
1. Describe how water is transformed from each stage in each of the pictures provided. The following terms should be used in your descriptions and may be used more than once. (decrease, increase, temperature)

Figure 1: Different forms of Water



Description:

Figure 2: Snow, Water, and Clouds



Description:

Physical Sciences		3.PS1.B.1
Core Idea **Component** **MLS**	**Matter and Its Interactions** **Types of Interactions of Matter** Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.	
Expectation Unwrapped [Clarification Statement: Examples of reversible changes could include materials such as water and butter at different temperatures. Examples of irreversible changes could include cooking an egg, freezing a plant leaf, and heating paper.] **SCIENCE AND ENGINEERING PRACTICES** **Engaging in Argument from Evidence** ● Engaging in argument from evidence in grades 3–5 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed worlds. ● Construct an argument with evidence to support a claim. **DISCIPLINARY CORE IDEAS** **Types of Interactions of Matter** ● Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. **CROSSCUTTING CONCEPTS** **Cause and Effect** ● Cause and effect relationships are routinely identified, tested, and used to explain change.		**DOK Ceiling** 3 **Item Format** Selected Response Constructed Response Technology Enhanced
Content Limits/Assessment Boundaries ● N/A		**Sample Stems** **Reversible & Irreversible** A science class is discussing how water

Possible Evidence

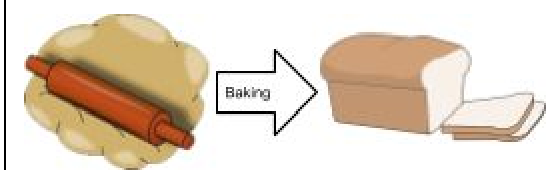
- Students will predict and investigate how effects of heating and cooling may change materials. (e.g. water melting, plastic melting)
- Students will identify and analyze data collected during the investigation to construct an argument about the effects of heating and cooling on materials and how some changes cannot be reversed.
- Students will describe physical changes (an egg being cracked or wood being ground into sawdust) are reversible, while chemical changes (cooking, baking, frying, burning, rusting, and heating) are irreversible.

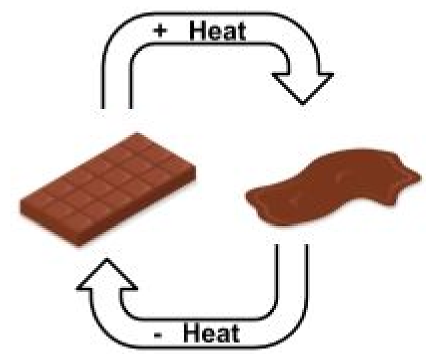
Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

changes from different states (liquid, solid, gas). Student A claims that **all** substances go through the same states and respond the same way to heating and cooling. Student B claims that water is different and goes through reversible changes, while some other substances undergo changes that are not reversible.

1. Use evidence to construct an argument that some changes caused by heating or cooling can be reversed and some cannot.





Grades 3-5 SCIENCE

Physical Sciences		3.PS2.B.1
Core Idea	**Motion and Stability: Forces and Interactions**	
Component	**Types of Interaction**	
MLS	Plan and conduct investigations to determine the cause and effect relationship of electric or magnetic interactions between two objects not in contact with each other.	

Expectation Unwrapped

[Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paper clips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects the strength of the force and how the orientation of magnets affects the direction of the magnetic force.]

SCIENCE AND ENGINEERING PRACTICES

Asking Questions and Defining Problems

- Ask questions that can be investigated based on patterns such as cause and effect relationships.

DISCIPLINARY CORE IDEAS

Types of Interactions

- Electric and magnetic forces between a pair of objects do not require the objects be in contact. The sizes of the forces in each situation depends on the properties of the objects, their distances apart, and, for forces between two magnets, on their orientation relative to each other.

CROSSCUTTING CONCEPTS

Cause and Effect

- Cause and effect relationships are routinely identified, tested, and used to explain change.

DOK Ceiling

3

Item Format

Selected Response
Constructed Response
Technology Enhanced

Content Limits/Assessment Boundaries

- Tasks should be limited to forces produced by objects that can be manipulated by students
- Electrical interactions are limited to static electricity.

Sample Stems

Magnet Investigations

Students conducted an investigation using horseshoe magnets and paper clips. The

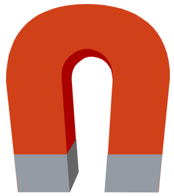
Possible Evidence

- Students ask questions that arise from observations of two objects not in contact with each other interacting through electric or magnetic forces, the answers to which would clarify the cause and effect relationships between the following:
    - The sizes of the forces on the two interacting objects due to the distance between the two objects
    - The relative orientation of two magnets and whether the force between the magnets is attractive or repulsive
    - The presence of a magnet and the force the magnet exerts on other objects
    - Electrically charged objects and an electric force
- Students' questions are investigated within the scope of the classroom.

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

students quickly discovered that the horseshoe magnet was attracted to the paper clip. But, they wondered how the distance between the magnet and paper clips would affect the attraction between the two.



Their investigation tested different <u>distances</u> between the paper clip and magnet.

Investigation 1 Data

Magnet Height Above Paper Clip (centimeters)	Paper Clip Response
25	no movement
20	no movement
15	moved slightly in one direction
10	rose up and stuck to magnet

1. Based on the observations made in Investigation 1, describe the relationship between the horseshoe magnet and the paper clip.

Grades 3-5 SCIENCE

<table>
<tr><th colspan="2">Life Sciences</th><th>3.LS1.B.1</th></tr>
<tr><td>Core Idea
Component
MLS</td><td colspan="2">From Molecules to Organisms: Structure and Processes
Growth and Development of Organisms
Develop a model to compare and contrast observations on the life cycle of different plants and animals.</td></tr>
<tr><td colspan="2" rowspan="2"><u>Expectation Unwrapped</u>

<u>SCIENCE AND ENGINEERING PRACTICES</u>
Developing and Using Models
● Develop models to describe phenomena.

<u>DISCIPLINARY CORE IDEAS</u>
Growth and Development of Organisms
● Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.

<u>CROSSCUTTING CONCEPTS</u>
Patterns
● Patterns of change can be used to make predictions.</td><td><u>DOK Ceiling</u>
3</td></tr>
<tr><td><u>Item Format</u>
Selected Response
Constructed Response
Technology Enhanced</td></tr>
<tr><td colspan="2"><u>Content Limits/Assessment Boundaries</u>

● Assessment of plant life cycles is limited to those of flowering plants.
● Tasks should not assess human reproduction.</td><td><u>Sample Stems</u>

A class goes on a school trip to learn about the types of organisms that live in a local river. They work in groups and use nets to collect organisms out of the river. They collect water striders and dragonflies (Figure 1). They make a data table to compare the traits of the water striders and dragonflies (Table 1).</td></tr>
</table>

Grades 3-5 SCIENCE

Possible Evidence

- Students develop models (e.g., conceptual, physical, drawing) to describe the phenomenon. In their models, students identify the relevant components of their models, including the following:
    - Organisms (both plant and animal)
    - Birth, growth, reproduction, and death
- In the models, students describe the relationships between components, including the following:
    - Organisms are born, grow, and die in a pattern known as a life cycle.
    - Different organisms' life cycles can look very different.
    - A causal direction of the cycle (e.g., without birth, there is no growth; without reproduction, there are no births)
- Students use the models to describe how, although organisms can display life cycles that look different, all organisms follow the same pattern.
- Students use the models to make predictions related to the phenomenon, based on patterns identified among life cycles (e.g., if there are no births, deaths will continue and eventually there will be no more of that type of organism).

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Figure 1. Reproductive Cycles

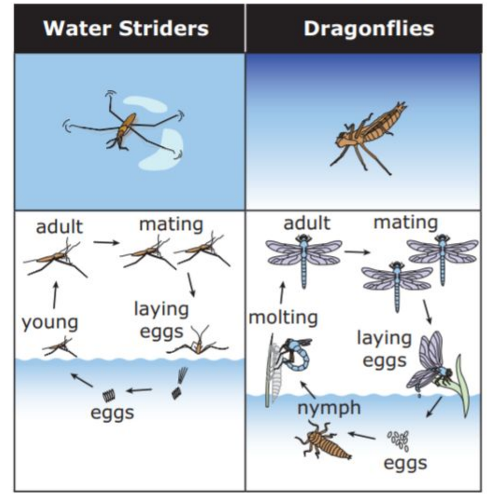
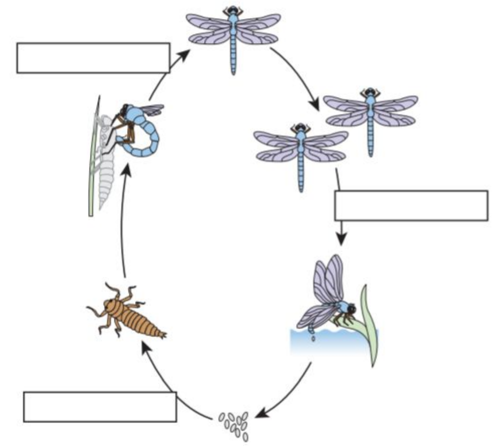


Table 1. Water Strider and Dragonfly Traits

Characteristic	Water Strider	Dragonfly
Body parts	6 thin legs that trap air bubbles with tiny hairs	6 thin legs and short antennae
Behavior	gather in swarms for feeding and mating; move rapidly on the surface of the water to catch insects for food	gather in swarms for feeding; catch insects for food
Appearance of adults	some have wings and some do not	adult form is brightly colored and has 2 sets of wings
Environment	can live in freshwater or saltwater	found only in freshwater and migrate when weather grows cold
Appearance of young	young look like smaller versions of adults	nymph has gills and short antennae

1. Complete the dragonfly life stage model below.



2. Use the model to describe how each stage you labeled is same/different in the water strider cycle.

Grades 3-5 SCIENCE

Life Sciences		3.LS3.A.1
Core Idea	**Heredity: Inheritance and Variation of Traits**	
Component	**Inheritance of Traits**	
MLS	Construct scientific arguments to support claims that some characteristics of organisms are inherited from parents and some are influenced by the environment.	

Expectation Unwrapped	**DOK Ceiling** 3
[Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; or, a pet dog that is given too much food and little exercise may become overweight.Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] **SCIENCE AND ENGINEERING PRACTICES** **Constructing Explanations and Designing Solutions** ● Use evidence (e.g., observations, patterns) to support an explanation. **DISCIPLINARY CORE IDEAS** **Inheritance of Traits** ● Many characteristics of organisms are inherited from their parents. ● Different organisms vary in how they look and function because they have different inherited information. ● Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. ● The environment also affects the traits that an organism develops. **CROSSCUTTING CONCEPTS** **Similarities and Differences** ● Similarities and differences in patterns can be used to sort and classify natural phenomena. **Cause and Effect** ● Cause and effect relationships are routinely identified and used to explain change. **ENGINEERING DESIGN CONNECTIONS** 3.ETS1.C.1	**Item Format** Selected Response Constructed Response Technology Enhanced

Content Limits/Assessment Boundaries

- Tasks should not include genetic mechanisms of inheritance and prediction of traits and is limited to non-human examples.

Possible Evidence

- Students organize the data (e.g., from students' previous work, grade-appropriate existing data sets) using graphical displays (e.g., tables, charts, graphs) to support the argument. The organized data may include the following:
  - o Traits of plant and animal parents
  - o Traits of plant and animal offspring
  - o Variations in similar traits in a grouping of similar organisms
- Students identify and describe patterns in the data, including:
  - o Similarities in the traits of a parent and the traits of an offspring (e.g., tall plants typically have tall offspring).
  - o Similarities in traits among siblings (e.g., siblings often resemble each other)
  - o Differences in traits in a group of similar organisms (e.g., dogs come in many shapes and sizes, a field of corn plants have plants of different heights)
  - o Differences in traits of parents and offspring (e.g., offspring do not look exactly like their parents)
  - o Differences in traits among siblings (e.g., siblings may not look exactly like their mother)
- Students describe the pattern of similarities in traits between parents and offspring and between siblings provides evidence that traits are inherited
- Students describe the pattern of differences in traits between parents and offspring and between siblings provides evidence that inherited traits can vary.
- Students describe the variation in inherited traits results in a pattern of variation in traits in groups of organisms that are of a similar type
- Students identify the given explanation to be supported with a statement that relates the phenomenon to a scientific idea, including that many inherited traits can be influenced by the environment.
- Students describe the given evidence that supports the explanation, including the following:
  - o Environmental factors that vary for organisms of the same type (e.g., amount or food, amount of water, the amount of exercise an animal gets, chemicals in the water) that may influence organisms' traits
  - o Inherited traits that vary between organisms of the same type (e.g., height or weight of a plant or animal, color or quantity of the flowers)

Sample Stems

Kiwi Birds

New Zealand is home to five different types of kiwi birds: the rowi, little spotted kiwi, the great spotted kiwi, the north island brown Kiwi, and the tokoeka kiwi.

Table 1 shows some characteristics of three of the five types of Kiwi birds.

Table 1: Characteristics of Kiwi Birds

Character istic	Great Spotted Kiwi	North Island Brown Kiwi	Tokoeka Kiwi
feathers	gray feathers with white bands	reddish brown spiky, fluffy feathers	soft feathers that range from gray to brown
habitat	harsh, snowy mountains	pine tree forests	wide variety (snowy mountain s to sandy beaches)
size	largest	smallest	medium
diet	fallen fruits and berries, insects, spiders	fungi, moths, centipedes, and frogs	insects, seeds, crayfish, frogs, spiders, worms (largest variety)

- o Observable inherited traits of organisms in varied environmental conditions
- Students use reasoning to connect the evidence and support an explanation about environmental influences on inherited traits in organisms.
- In their chain of reasoning, students describe a cause and effect relationship between a specific causal environmental factor and its effect on a given variation in a trait (e.g., not enough water produces plants that are shorter and have fewer flowers than plants that had more water available).

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Below are pictures of the three kiwi birds mentioned in Table 1.

Great Spotted Kiwi

North Island Brown Kiwi

Tokoeka Kiwi

1. a. Identify whether the size of the kiwis was most likely inherited from their parents or influenced by their environment.
   b. Use evidence to explain your reasoning for Part A.
2. Identify if the diet of the kiwi is most likely inherited from their parents or influenced by their environment.
   b. Use evidence to explain your reasoning for Part A.

<table>
<tr><th colspan="2">Life Sciences</th><th>3.LS3.B.1</th></tr>
<tr><td>Core Idea</td><td colspan="2">Heredity: Inheritance and Variation of Traits</td></tr>
<tr><td>Component</td><td colspan="2">Natural Selection</td></tr>
<tr><td>MLS</td><td colspan="2">Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving and finding mates.</td></tr>
<tr><td colspan="2"><u>Expectation Unwrapped</u>

[Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.]

<u>SCIENCE AND ENGINEERING PRACTICES</u>
Constructing Explanations and Designing Solutions
● Use evidence (e.g., observations, patterns) to construct an explanation.

<u>DISCIPLINARY CORE IDEAS</u>
Natural Selection
● Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing.

<u>CROSSCUTTING CONCEPTS</u>
Cause and Effect
● Cause and effect relationships are routinely identified and used to explain change.

<u>ENGINEERING DESIGN CONNECTIONS</u>
3.ETS1.B.1</td><td><u>DOK Ceiling</u>
3

<u>Item Format</u>
Selected Response
Constructed Response
Technology Enhanced</td></tr>
<tr><td colspan="2"><u>Content Limits/Assessment Boundaries</u>

● Tasks are limited to non-human examples.</td><td><u>Sample Stems</u>
Kiwi Birds
New Zealand is home to five different types of kiwi birds: the rowi, little spotted kiwi, the</td></tr>
</table>

Possible Evidence

- Students make a scientific statement about how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.
- Students use evidence and reasoning to construct an explanation for the phenomenon (observable event).
- Students describe the given evidence necessary for the explanation, including the following:
  - A given characteristic of a species (e.g., thorns on a plant, camouflage of an animal, the coloration of moths)
  - The patterns of variation of a given characteristic among individuals in a species (e.g., longer or shorter thorns on individual plants, dark or light coloration of animals)
  - Potential benefits of a given variation of the characteristic (e.g., the light coloration of some moths makes them difficult to see on the bark of a tree)
- Students use reasoning to logically connect the evidence to support the explanation for the phenomenon.
- Students describe a chain of reasoning that includes the following:
  - That certain variations in characteristics make it harder or easier for an animal to survive, find mates, and reproduce (e.g., longer thorns prevent predators more effectively and increase the likelihood of survival; light coloration of some moths provides camouflage in certain environments, making it more likely that they will live long enough to be able to mate and reproduce)
  - That the characteristics that make it easier for some organisms to survive, find mates, and reproduce give those organisms an advantage over other organisms of the same species that don't have those traits
  - That there can be a cause and effect relationship between a specific variation in a characteristic (e.g., longer thorns, coloration of moths) and its effect on the ability of the individual organism to survive and reproduce (e.g., plants with longer thorns are less likely to be eaten, darker moths are less likely to be seen and eaten on dark trees).

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

great spotted kiwi, the north island brown Kiwi, and the tokoeka kiwi.

Table 1 shows some characteristics of three of the five types of Kiwi birds.

Table 1: Characteristics of Kiwi Birds

Characteristic	Great Spotted Kiwi	North Island Brown Kiwi	Tokoeka Kiwi
feathers	gray feathers with white bands	reddish brown spiky, fluffy feathers	soft feathers that range from gray to brown
habitat	harsh, snowy mountains	pine tree forests	wide variety (snowy mountains to sandy beaches)
size	largest	smallest	medium
diet	fallen fruits and berries, insects, spiders	fungi, moths, centipedes, and frogs	insects, seeds, crayfish, frogs, spiders, worms (largest variety)

1. Use evidence from the table to provide an explanation for the variation in feather color among the three types of Kiwi birds.

	A student claims the following: Tokoeka Kiwi birds have a better chance of surviving compared to the Great Spotted Kiwi or the North Island Brown Kiwi. 2. a. Identify whether you agree or disagree with the student's claim. b. Use evidence from the table to provide reasoning for your answer to Part A.

Grades 3-5 SCIENCE

Life Sciences		3.LS3.C.1
Core Idea	**Heredity: Inheritance and Variation of Traits**	
Component	**Adaptation**	
MLS	Construct an argument with evidence that in a particular ecosystem some organisms — based on structural adaptations or behaviors — can survive well, some survive less well, and some cannot.	

Expectation Unwrapped	**DOK Ceiling**
[Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.] **SCIENCE AND ENGINEERING PRACTICES** **Engaging in Argument from Evidence** ● Construct an argument with evidence.. **DISCIPLINARY CORE IDEAS** **Adaptation** ● For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. **CROSSCUTTING CONCEPTS** **Cause and Effect** ● Cause and effect relationships are routinely identified and used to explain change. **ENGINEERING DESIGN CONNECTIONS** ● 3.ETS1.B.1	3 **Item Format** Selected Response Constructed Response Technology Enhanced

Content Limits/Assessment Boundaries	**Sample Stems**
● Assessment should be limited to regional ecosystems (Missouri): prairies, forests, lakes, rivers.	**Kiwi Bird Survival** Kiwi hatchlings are left at a very young age, they are vulnerable to predators. It is

Possible Evidence

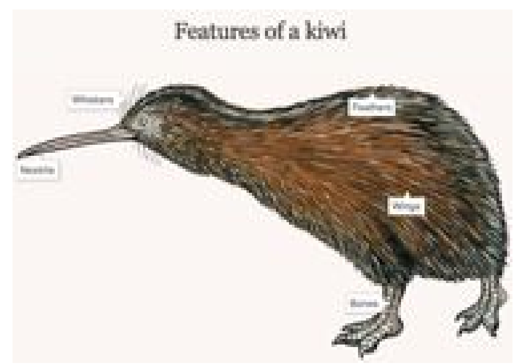
- Students make a claim to be supported about a phenomenon. In their claim, students include the idea that in a particular habitat, some organisms can survive well, some survive less well, and some cannot survive at all.
- Students describe the given evidence necessary for supporting the claim, including the following:
  - Characteristics of a given particular environment (e.g., soft earth, trees and shrubs, seasonal flowering plants)
  - Characteristics of a particular organism (e.g., plants with long, sharp leaves; rabbit coloration)
  - Needs of a particular organism (e.g., shelter from predators, food, water)
- Students evaluate the evidence to determine the following:
  - The characteristics of organisms that might affect survival
  - The similarities and differences in needs among at least three types of organisms
  - How and what features of the habitat meet the needs of each of the organisms (e.g., the degree to which a habitat meets the needs of an organism)
  - How and what features of the habitat do not meet the needs of each of the organisms (i.e., the degree to which a habitat does not meet the needs of an organism)
- Students evaluate the evidence to determine whether it is relevant to and supports the claim.
- Students describe whether the given evidence is sufficient to support the claim and whether additional evidence is needed.

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

speculated they might have become nocturnal to avoid the Haast's eagle and Eyles' harrier. New animals introduced to the area and the growing human population are a more severe threat. Predators include dogs, feral cats and even wild pigs dig up kiwi burrows. Approxamently 5% of wild kiwi chicks survive the first six months. Once there were an estimated 12 million kiwis, but by 2006 there were fewer than 100,000. Kiwi birds have long whiskers on their faces, to help them find their way around, especially in the dark. A kiwi's feathers lack the barbs and hook-lets like other birds' feathers. Kiwi feathers are more like rabbit fur. A kiwi's nostrils are at the base of its beak, not at the top as with other birds like the Kea. Their nostrils give the kiwi a strong sense of smell to sniff out worms down in the soil.

1. Describe how the following features of a kiwi bird, labeled on the model below, aid in its survival.



	Kiwis are being driven to extinction by three main threats; predators, lost habitat and people. Kiwis have few defenses against introduced predators like stoats and cats, and their native forest habitat has been dramatically reduced to make way for human habitation and farmland. The effects of early hunting and trapping has caused kiwi populations to fragment (break down) and they are unable to reproduce quickly enough. As kiwi populations decline and become fragmented, sex ratios (male to female) skew and the effective breeding population continues to decline. 2. Describe the elements that make survival hard for kiwi birds. What is causing drastic decline in the kiwi population? 3. Describe the traits and adaptations help kiwi birds survive. 4. Describe the relationship between human population increase and kiwi population? 5. Construct an argument with evidence (agree or disagree) that in their native forest habitat some kiwi birds can survive well, some survive less well, and some cannot.

A zoo in Missouri wants to build a new enclosure for yellow mud turtles, which are native to parts of the state.

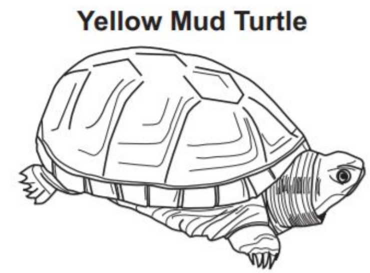


Table 1 shows some features of yellow mud turtles in the wild and some characteristics of the new zoo enclosure.

Table 1: Turtle Features and Zoo Characteristics

Yellow Mud Turtle Features	Zoo Enclosure Characteristics
• feeds on leeches, fish, frogs, snails, crayfish, tadpoles, and insects • spends half of its time in water and half on land near ponds and rivers	• will include short grasses and plants • will be home to several species of insects

1. Describe how the turtles will be positively affected by the new zoo enclosure.
2. Describe how the turtles will be negatively affected by the zoo enclosure.
3. Describe one way in which the zoo enclosure could be changed to help the turtles.

Grades 3-5 SCIENCE

Life Sciences		3.LS3.D.1
Core Idea	**Heredity: Inheritance and Variation of Traits**	
Component	**Biodiversity and Humans**	
MLS	Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.	

Expectation Unwrapped	DOK Ceiling
[Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.] **SCIENCE AND ENGINEERING PRACTICES** **Engaging in Argument from Evidence** ● Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. **DISCIPLINARY CORE IDEAS** **Biodiversity and Humans** ● When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, some move to new locations, some move into the transformed environment, and some die. ● Populations live in a variety of habitats, and change in those habitats affects the organisms living there. **CROSSCUTTING CONCEPTS** **Systems and Systems Model** ● A system can be described in terms of its components and their interactions. ● Knowledge of relevant scientific concepts and research findings is important in engineering. **ENGINEERING DESIGN CONNECTIONS** ● 3.ETS1.B.1	3 **Item Format** Selected Response Constructed Response Technology Enhanced

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Content Limits/Assessment Boundaries

- Grade 3 tasks are limited to a single environmental change's cause and effect.
- Tasks should not include the greenhouse effect or climate change.

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Sample Stems

A student read the following article about the ocean.

"Coral reefs are being threatened by water temperature and seawater changes. You can help keep corals healthy by not putting more stress or danger to the reefs. At the beach, be sure to throw away your trash in the right places. Do not touch or step on the corals. When boating, stay away from the reefs and don't drop your anchor near them."

The student makes the following claim:
"Coral reefs are in danger and we need to change the water temperature."

1. a. Identify whether the claim is correct or not correct.
   b. Use evidence from the article to support your answer to Part A.

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Possible Evidence

- Students make a claim about the merit of a given solution to a problem that is caused when the environment changes, which results in changes in the types of plants and animals that live there.
- Students describe the given evidence about how the solution meets the given criteria and constraints. This evidence includes the following:
  - A system of plants, animals, and a given environment within which they live before the given environmental change occurs
  - A given change in the environment
  - How the change in the given environment causes a problem for the existing plants and animals living within that area
  - The effect of the solution on the plants and animals within the environment.
  - The resulting changes to plants and animals living within that changed environment, after the solution has been implemented
- Students evaluate the solution to the problem to determine the merit of the solution.
- Students describe how well the proposed solution meets the given criteria and constraints to reduce the impact of the problem created by the environmental change in the system, including the following:
  - How the solution makes changes to one part of the system (e.g., a feature of the environment), affecting the other parts of the system (e.g., plants and animals)
  - How the solution affects plants and animals
- Students evaluate the evidence to determine whether it is relevant to and supports the claim.
- Students describe whether the given evidence is sufficient to support the claim and whether additional evidence is needed.

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Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

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Earth and Space Sciences		3.ESS2.D.1
Core Idea	**Earth's Systems**	
Component	**Weather and Climate**	
MLS	Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.	

Expectation Unwrapped	**DOK Ceiling**
[Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] **SCIENCE AND ENGINEERING PRACTICES** **Analyzing and Interpreting Data** ● Represent data in tables and various graphical displays (e.g., bar graphs, line graphs, pictographs) to reveal patterns that indicate relationships. **DISCIPLINARY CORE IDEAS** **Weather and Climate** ● Scientists record patterns of the weather across different times and areas so they can make predictions about what kind of weather might happen next. **CROSSCUTTING CONCEPTS** **Patterns** ● Patterns of change can be used to make predictions.	3 **Item Format** Selected Response Constructed Response Technology Enhanced
Content Limits/Assessment Boundaries	**Sample Stems**
● Graphical displays are limited to line graphs, pictographs, and bar graphs. ● Tasks should not include climate change. ● Tasks can include any geographic location as long as sufficient background knowledge is provided. ● Data for weather should be given in the following units: Temperature (degrees Fahrenheit), Precipitation (inches), and Wind Speed (miles per hour).	A hurricane is approaching the coast. Students are concerned and check weather data every hour. Weather scientists online explain that hurricanes cause a sudden rise in the sea level and high wind speeds. The students record the data from the weather

Possible Evidence

- Students use graphical displays (e.g., tables, charts, graphs) to organize the given data by season, including the following:
  - Weather condition data (e.g., average temperature in degrees Fahrenheit, precipitation in inches, wind direction in miles per hour) from the same area across multiple seasons
  - Weather condition data from different areas (e.g., hometown and a town in another state)
- Students recognize and then describe patterns of weather conditions across the following:
  - Different seasons (e.g., cold and dry in the winter, hot and wet in the summer; more or less wind in a particular season)
  - Different areas (e.g., a town in the Pacific Northwest has high precipitation, while a town in the Southwest has low precipitation)
- Students use patterns of weather conditions in different seasons and different areas to predict the following:
  - The typical weather conditions expected during a particular season (e.g., “In our town, in the summer it is typically hot, as indicated on a line graph over time, while in the winter it is typically cold; therefore, the prediction is that next summer it will be hot and next winter it will be cold.”).
  - The typical weather conditions expected during a particular season in different areas.

Stimulus Materials

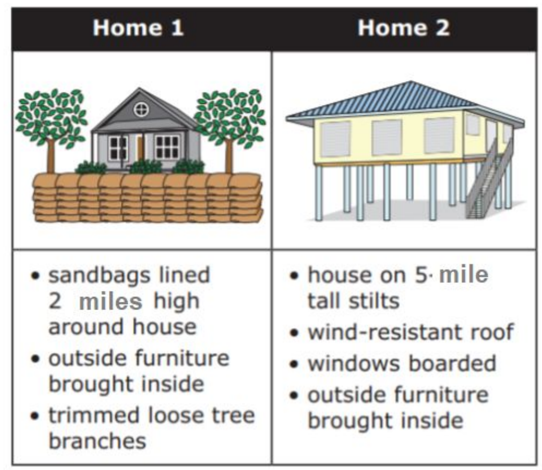
Graphic organizers, diagrams, graphs, data tables, drawings

reports as shown in Table 1.

Time	Wind Speed (miles per hour)	Rise of Sea Water (inches)	Distance from Coast (miles)
9:00am	140	59	373
10:00am	143	95	305
11:00am	146	158	233
12:00pm	143	169	174
1:00pm	140	169	118
2:00pm	134	169	68
3:00pm	127	169	37
4:00pm	99	177	13

When weather scientists warn that a hurricane is approaching the coast, people must make changes to their lives and daily routines. They begin to prepare their homes for the storm. Two homeowners who live within one mile of the beach prepare their homes as shown in Figure 1.

Figure 1. Preparation of Homes



Following the hurricane, the students compare the storm with previous hurricanes using the data in Table 2.

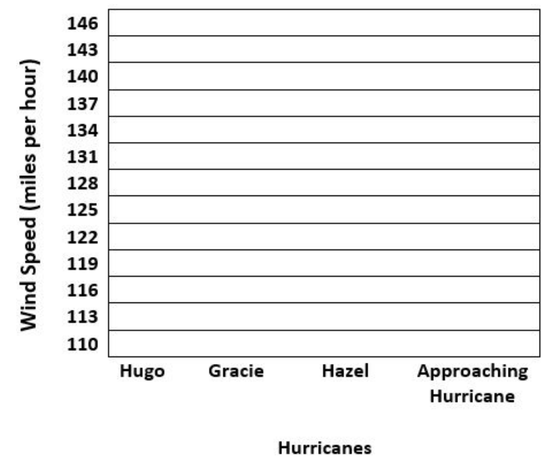
Table 2: Most Damaging South Carolina Hurricanes

Hurricane	Highest Wind Speed (miles per hour)	Highest Rise of Sea Water (inches)	Estimated Damage Cost
Hugo	140	217	$14.1 billion
Gracie	124	106	$120 million
Hazel	140	205	$1.5 billion

Source: South Carolina Department of Natural Resource

1. Use Tables 1 and 2 to create a bar graph of highest wind speeds to compare past hurricanes with the approaching hurricane. Draw and shade each bar to the correct height.

Highest Hurricane Wind Speed



2. According to the data provided in Table 1, how does the strength of the approaching hurricane change over time?

Grades 3-5 SCIENCE

Earth and Space Sciences		3.ESS2.D.2
Core Idea	**Earth's Systems**	
Component	**Weather and Climate**	
MLS	Obtain and combine information to describe climates in different regions of the world.	

Expectation Unwrapped	DOK Ceiling / Item Format
SCIENCE AND ENGINEERING PRACTICES **Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and other reliable media to explain phenomena (observable events). **DISCIPLINARY CORE IDEAS** **Weather and Climate** ● Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over the years. **CROSSCUTTING CONCEPTS** **Patterns** ● Patterns of change can be used to make predictions.	**DOK Ceiling** 3 **Item Format** Selected Response Constructed Response Technology Enhanced

Content Limits/Assessment Boundaries	Sample Stems
● Assessment of information is limited to narrative accounts and graphical displays of data that can include multiple data points (e.g., temperature, precipitation). ● Tasks should not include data dealing with climate change.	A teacher shares a map of the world with her class and asks: "If you could take a trip around the world, would you know what types of clothes to pack?" She indicates stops in Brazil near the tropical rainforest, Greenland, the northernmost country in the world, Kansas, near the center of the US, and the Sahara Desert in Chad, a country in Africa. The students make different claims about the clothes they need for each stop.

Possible Evidence

- Students use books and other reliable media to gather information about the following:
  - Climates in different regions of the world (e.g., equatorial, polar, coastal, mid-continental).
  - Variations in climates within different regions of the world (e.g., an area's average temperatures and precipitation during various months over several years, an area's average rainfall and temperatures during the rainy season over several years).
- Students combine obtained information to provide evidence about the climate pattern in a region that can be used to make predictions about typical weather conditions in that region.
- Students use the information they obtained and combined to describe the following:
  - Climates in different regions of the world
  - Examples of how patterns in climate could be used to predict typical weather conditions
  - How climate can vary over the years in different regions of the world

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Student A: I will need a pair of shorts for Brazil and the Sahara Desert, but a winter coat for Kansas and an umbrella for Greenland.
Student B: I will need an umbrella for Brazil, a winter coat for Greenland, and shorts for Kansas and the Sahara Desert.
Student C: I will need a winter coat for Brazil and Greenland, shorts for Kansas, and an umbrella for the Sahara Desert.
Student D: I will need a pair of shorts for Brazil, an umbrella for Greenland and Kansas, and a winter coat for the Sahara Desert.

1. a. Which student is most correct?
   b. Provide evidence from the passage for your answer to Part A.

Grades 3-5 SCIENCE

Earth and Space Sciences		3.ESS3.B.1
Core Idea	**Earth and Human Activity**	
Component	**Natural Hazards**	
MLS	Make a claim about the merit of an existing design solution (e.g. levees, tornado shelters, sea walls, etc.) that reduces the impacts of a weather-related hazard.	

Expectation Unwrapped	DOK Ceiling
[Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind-resistant roofs, and lightning rods.] **SCIENCE AND ENGINEERING PRACTICES** **Engaging in Argument from Evidence** ● Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. **DISCIPLINARY CORE IDEAS** **Natural Hazards** ● A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. **CROSSCUTTING CONCEPTS** **Cause and Effect** ● Cause and effect relationships are routinely identified, tested, and used to explain change. **INFLUENCE OF ENGINEERING, TECHNOLOGY, AND SCIENCE ON SOCIETY AND THE NATURAL WORLD** ● Engineers improve existing technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones). **ENGINEERING DESIGN CONNECTIONS** ● 3.ETS1.A.1	3 **Item Format** Selected Response Constructed Response Technology Enhanced

Content Limits/Assessment Boundaries

- N/A

Possible Evidence

- Students make a claim about the merit of a given design solution that reduces the impact of a weather-related hazard.
- Students describe the given evidence about the design solution, including evidence about the following:
  - The given weather-related hazard (e.g., heavy rain or snow, strong winds, lightning, flooding along river banks)
  - Problems caused by the weather-related hazard (e.g., heavy rains cause flooding, lightning causes fires)
  - How the proposed solution addresses the problem (e.g., dams and levees are designed to control flooding, lightning rods reduce the chance of fires) [note: mechanisms are limited to simple observable relationships that rely on logical reasoning]
- Students evaluate the evidence using given criteria and constraints to determine the following:
  - How the proposed solution addresses the problem, including the impact of the weather-related hazard after the design solution has been implemented
  - The merits of a given solution in reducing the impact of a weather-related hazard (i.e., whether the design solution meets the given criteria and constraints)
  - The benefits and risks a given solution poses when responding to the societal demand to reduce the impact of a hazard

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Sample Stems

Galveston is an island south of Texas. In September 1900, Galveston had one of the worst disasters in United States history when it was hit by a very powerful storm.

On the morning of September 1900, people saw the ocean waves hitting the beach. The waves kept getting higher and higher. The wind was so strong it blew signs and garbage cans over, as well as bending trees. At 6:00 p.m. that night, the wind blew things off the weather building. The hard winds and 15 feet high waves caused flooding on the island. Many buildings and homes were lost.

1. Using information in the passage, describe one way the people of Galveston could have kept their town from flooding. [Give options if needed.]
2. Which statement explains why the storm in Galveston caused so much damage?

Grades 3-5 SCIENCE

Engineering, Technology, and Application of Science		3.ETS1.A.1
Core Idea	**Engineering Design**	
Component	**Defining and Delimiting Engineering Problems**	
MLS	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.	

Expectation Unwrapped	**DOK Ceiling**
	3
SCIENCE AND ENGINEERING PRACTICES **Asking Questions and Defining Problems** ● Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. **DISCIPLINARY CORE IDEAS** **Defining and Delimiting Engineering Problems** ● Possible solutions to a problem are limited by the available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. **INFLUENCE OF SCIENCE, ENGINEERING, AND TECHNOLOGY ON SOCIETY AND THE NATURAL WORLD** ● People's needs and wants change over time, as do their demands for new and improved technologies. **CONNECTIONS TO DISCIPLINARY CORE IDEAS** 3.ESS3.B.1	**Item Format** Selected Response Constructed Response Technology Enhanced

Content Limits/Assessment Boundaries	**Sample Stems**
● Actual data production should not be expected unless it can be simulated on the assessment. ● Simple data should be given in a single bar graph, a line graph, a line plot, or a pictograph.	Students on a playground are not able to hear their teacher's whistle. They decide to test three new whistles to identify a whistle they can hear. They use a special app on a cell phone placed 3 meters away from the

Possible Evidence

- Students use given scientific information and information about a situation or phenomenon to define a simple design problem that includes responding to a need or want.
- Students design a problem that can be solved with the development of a new or improved object, tool, process, or system.
- Students describe how people's needs and wants change over time.
- Students define the limits within which the problem will be addressed, which includes addressing something people want and need at the current time.
- Based on the situation people want to change, students specify criteria (required features) of a successful solution.

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

whistles to examine the sound waves from each whistle. Figure 1 shows the height of each sound wave.

Figure 1

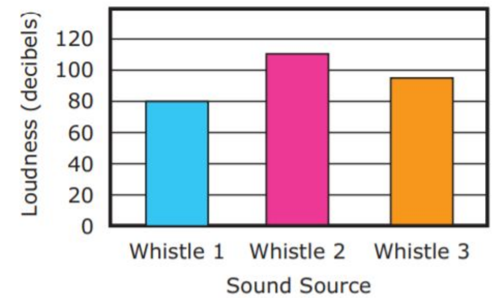
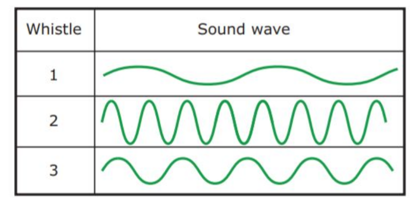


Figure 2 shows the spacing between each wave peak

Figure 2



Next, they explore whether the sound that comes out of each whistle can move objects. They place several, identical small foam balls on a table. Students blow each whistle 1 meter away from the foam balls. They record their observations in Table 1.

Table 1

Whistle	Distance Foam Ball Rolled
1	0 centimeters
2	2 centimeters
3	1 centimeter

1. The students observed that sound moved the foam balls. They wonder whether louder sounds cause more

motion. Describe how they should change the investigation to answer this question.

The students notice that it is more difficult to hear the teacher's whistle as they move farther from the teacher on the playground. This makes them curious about how sound can travel very long distances using cell phones between different cities that are hundreds of kilometers apart. The students connect two plastic cups with a 50-meter-long string between them. One student blows the whistle into a cup while another student listens into the other cup 50 meters away. Other students on the playground cannot hear the whistle inside the cup, but the student listening into the plastic cup 50 meters away can hear the whistle clearly. They call their device a plastic cup phone, but know that it is different from a cell phone.

2. Match the features with the type of phone they describe. Write the correct answers in each box.

	A. transfers sound by digital signals B. transfers sound by movement C. transfers sound over very long distances D. transfers sound through a code **Cell phone** / **Plastic cup phone**

Grades 3-5 SCIENCE

Engineering, Technology, and Application of Science		3.ETS1.B.1
Core Idea	**Engineering Design**	
Component	**Developing Possible Solutions**	
MLS	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.	

Expectation Unwrapped	**DOK Ceiling**
	3
SCIENCE AND ENGINEERING PRACTICES **Constructing Explanations and Designing Solutions** ● Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. **DISCIPLINARY CORE IDEAS** **Developing Possible Solutions** ● Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. ● At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. **INFLUENCE OF SCIENCE, ENGINEERING, AND TECHNOLOGY ON SOCIETY AND THE NATURAL WORLD** ● Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. **CONNECTIONS TO DISCIPLINARY CORE IDEAS** 3.LS3.B.1 3.LS3.C.1	**Item Format** Selected Response Constructed Response Technology Enhanced
Content Limits/Assessment Boundaries	**Sample Stems**
● Actual data production should not be expected unless it can be simulated on the assessment. ● Simple data should be given in a bar graph, a line graph, a line plot, or a pictograph.	**Storm Surge Problem/Solution** An example of a storm surge. A **storm surge** is a sudden rise of water hitting areas close to the coast. Storm surges are usually created by a hurricane or other tropical cyclone. The surge happens because

Possible Evidence

- Students use grade-appropriate information from research about a given problem, including the causes and effects of the problem and relevant scientific information.
- Students generate at least two possible solutions to the problem based on scientific information and understanding of the problem.
- Students specify how each design solution solves the problem.
- Students share ideas and findings with others about design solutions to generate a variety of possible solutions.
- Students describe the necessary steps for designing a solution to a problem, including conducting research and communicating with others throughout the design process to improve the design [note: emphasis is on what is necessary for designing solutions, not on a stepwise process].
- Students identify the given criteria (required features) and constraints (limits) for the solutions, including increasing benefits, decreasing risks/costs, and meeting societal demands as appropriate.
- Students specify how the criteria and constraints will be used to generate and test the design solutions.
- Students test each solution under a range of likely conditions and gather data to determine how well the solutions meet the criteria and constraints of the problem.
- Students use the collected data to compare solutions based on how well each solution meets the criteria and constraints of the problem.

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

a storm has fast winds. These winds push the water on shore, causing the water level to rise. Strong storm surges can flood coastal towns and destroy homes. A storm surge is considered the deadliest part of a hurricane. They harm many people each year.

1. Generate a list of suggestions for how to prepare for storm surge/flooding.

Solution	**Criteria & Limitations**	**Did it meet the criteria?**
1.		
2.		

Engineering, Technology, and Application of Science		3.ETS1.C.1
Core Idea	**Engineering Design**	
Component	**Optimizing the Solution Process**	
MLS	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	

Expectation Unwrapped	DOK Ceiling
SCIENCE AND ENGINEERING PRACTICES **Planning and Carrying Out Investigations** ● Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. **DISCIPLINARY CORE IDEAS** **Developing Possible Solutions** ● Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. **Optimizing the Design Solution** ● Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. **INFLUENCE OF SCIENCE, ENGINEERING, AND TECHNOLOGY ON SOCIETY AND THE NATURAL WORLD** ● People's needs and wants change over time, as do their demands for new and improved technologies. ● Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. **CONNECTIONS TO DISCIPLINARY CORE IDEAS** 3.PS1.A.1 3.LS3.A.1	3 **Item Format** Selected Response Constructed Response Technology Enhanced

Content Limits/Assessment Boundaries

- Actual data production should not be expected unless it can be simulated on the assessment.
- Simple data should be given in a bar graph, a line graph, a line plot, or a pictograph.

Possible Evidence

- Students describe the purpose of the investigation, which includes finding possible failure points or difficulties to identify aspects of a model or prototype that can be improved.
- Students describe the evidence to be collected, including the following:
    - How well the model/prototype performs against the given criteria and constraints.
    - Specific aspects of the prototype or model that do not meet one or more of the criteria or constraints (e.g., failure points, difficulties).
    - Aspects of the model/prototype that can be improved to better meet the criteria and constraints.
- Students describe how the evidence is relevant to the purpose of the investigation.

Stimulus Materials

Graphic organizers, diagrams, graphs, data tables, drawings

Sample Stems

A class is doing an investigation on what kind of boat will stay afloat holding 10 pennies. They research and find the following:

1. Metal boats float most often.
2. Boats float longer if water is unable to get inside the boat.
3. A boat must be strong enough to hold certain weights. If too much weight is added, it will sink.

The teacher fills up a large tub of water and tells the students their boat must float in the tub holding the pennies. The students must choose to build a boat from the following materials:

- paper,
- cloth,
- Aluminum foil,
- or wax paper.
-

Each student will receive a 12 cm x 12 cm size of the material they choose.

Their first problem is to figure out what materials will float on water. The students

	try each of the materials, folding and bending it in different ways. 1. Identify the constraints of the different materials. The students figure out only one of the materials will float and bend to make a boat. Students then construct a boat all from the same type of material, but are told to create their own unique designs. Students then test each of their designs. 1. Describe the type of design that would work best. 2. a. Aside from the materials available during this investigation, identify a material that would allow the boat to float while holding more than 10 pennies. b. Describe your reasoning for the material chosen in Part A.